Quality Control of satellite radiances

- Purpose: To eliminate data which cannot be properly simulated or used -- Not just to eliminate observations with large observational errors.
- Single “bad” observation has more negatives than the positives from a lot of “good” ones.
- Multi-stage

Quality control – filtering of data

- Selection of observations.
  - HIRS -- Every 20th FOV + Cosine filter for lattitudes greater than 30^{o}. Profile used chosen based on location over open ocean and how likely it is to pass window check.
  - MSU – All used except first and last scan positions.
  - AMSU-A – Every 4th profile
  - AMSU-B – Every 12th profile
  - GOES – Every 3rd 5x5 box.

Quality control – Initial channel rejections

- Channels which at this time are not used.
  - HIRS
    - Channel 1 – Too much signal above top of model
    - Channels 16, 17 – Inadequate radiative transfer
    - Channels 18, 19 – Solar reflection
  - MSU – Channel 1 Surface emissivity (used for Q.C.)
  - AMSU-A
    - Channels 11-14 – Too much signal above top of model
  - AMSU-B – All used
  - GOES – Channels 16-18 see HIRS

Quality control – HIRS gross window check

- Linear regression simulation of SST based on channels 8 and 10.
- Differences greater than 8 degrees → channels 4-11, 13-15 eliminated.

Quality control – Basic rejections based on underlying surface

- Transition regions between land – sea – ice – snow.
  - No HIRS Channels 5-11, 13-15
  - No MSU Channels 1-2
  - No AMSU-A Channels 1-6, 15
  - No AMSU-B
  - No GOES

Quality control – Basic rejections based on underlying surface

- Land Surface and Sea Ice
  - No HIRS Channels 5-11, 13-15
  - No MSU Channels 1-2
  - No AMSU-A Channels 1-5, 15
  - No AMSU-B
  - No GOES

Quality control – MSU

- |Ch1 – Ch1 (simulated and Bias corrected)| = |(ch1diff)| > 5. Channel 2 eliminated

Quality control – MSU (cont.)

- Surface height > 2000. Channel 2 eliminated.
- Model and high resolution topography different channel 2 down weighted.
- Sensitivity to surface over land – channel eliminated.
- Modified 3 sigma check – channel by channel
  - Tighter in tropics, over land and where surface height differences large.

Quality control – AMSU-A

- Scattering index -5. > 10. Eliminates channels 1-6, 15.
- Cloud liquid water estimate > .3 eliminates channels 1-5, 15.
- Based on emissivity change necessary to fit radiances channels 1-5,15 eliminated if over threshold for channels 1, 2 or 3.
- Channels 1-6,15 down weighted based scattering index and cloud liquid water estimate.

Quality control – AMSU-A (cont.)

- Inability to fit channel 6 or channel 4 eliminates channels 1-6,15 or 1-5,15 respectively.
- Model and high resolution topography different, channels 1-5,15 down weighted.
- Sensitivity to surface over land – channel eliminated.
- Modified 3 sigma check – channel by channel
  - Tighter in tropics, over land and where surface height differences large.

Quality control – AMSU-B

- Scattering index and |ch1diff| based quality control. Eliminates all channels.
- Channels down weighted based on scattering index and |ch1diff|.
- Modified 3 sigma check – channel by channel
  - Tighter in tropics, over land and where surface height differences large.

Quality control – HIRS

- Ch4 – Ch4 (simulated and Bias corrected) (ch4diff) < -20. – All channels eliminated
- Ch4diff < -1. – Channels 3-15 eliminated.
- |Ch4diff| >1. and |ch5diff| > 1. Channels 4-15 eliminated.
- |Ch8diff| >1. Channels 5-11, 13-15 eliminated.
- Ch12diff < 10. Channels 4-15 eliminated.

Quality control – HIRS (cont.)

- Surface height > 2000. Channels 4 and 12 eliminated.
- Solar zenith angle < 60. Channels 13-15 eliminated.
- Model and high resolution topography different observation downweighted.
- Sensitivity to surface over land – channel eliminated.
- Modified 3 sigma check – channel by channel
  - Tighter in tropics, over land and where surface height differences large.